

<b>5E3111</b>	Roll No. : _____	Total Printed Pages : <span style="border: 1px solid black; padding: 2px;">4</span>
	<b>5E3111</b>	
	<b>B. Tech. (Sem. V) (Main/Back) Examination, December - 2013</b> <b>Electronics &amp; Communication</b> <b>5EC5 Microwave Engg. - I</b>	

Time : 3 Hours]

[Total Marks : 80

[Min. Passing Marks : 24

*Attempt any five questions. Selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.*

Use of following supporting material is permitted during examination.  
(Mentioned in form No. 205)

1. \_\_\_\_\_ **NIL** \_\_\_\_\_                      2. \_\_\_\_\_ **NIL** \_\_\_\_\_

### UNIT - I

- 1 (a) Start from Maxwell's equations derive the electric field  $E_x$  and  $E_y$  for a rectangular wave guide when a TE mode field is propagating in z-direction assume the cross section of the waveguide is  $a \times b$  m<sup>2</sup>. 12
- (b) Draw the magnetic field lines on the top surface for  $TE_{20}$  and  $TE_{11}$  mode. 4

**OR**

- 1 (a) Explain the reasons for
- (i) TEM mode not possible in rectangular waveguide.
- (ii) Why phase and group velocity are not same in waveguide. 4×2=8



- (b) Find the group and phase velocity for a waveguide having cross section (4mm × 6mm) and filled with a dielectric material with  $E_r=10$  and  $H_r=1$ .

8

## UNIT - II

- 2 Draw the structure for a
- (i) Wave guide bend with minimum reflection at corner.
  - (ii) Two-hole coupled directional coupler.
  - (iii) Rat-race structure and
  - (iv) Dielectric attenuator.

4×4=16

OR

- 2 Find the S-parameter for a
- (i) E-plane – Tee
  - (ii) Circulator
  - (iii) H-Plane – Tee and
  - (iv) Magic – Tee

4×4=16

## UNIT - III

- 3 Find the expression for current across a catcher cavity in two-cavity klystron. Also deduce the expression for
- (i) depth of modulation
  - (ii) bunching parameter

12+2×2=16

OR

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[Contd...

3 A four cavity cw Klystron amplifier has

Beam voltage = 20 kV

Beam current = 2.00 mA

Gap distance = 0.5 cm

Operating frequency  $f = 12.5$  GHz

Signal voltage  $\vartheta_1 = 5$  volt (rms)

Coupling coefficient = 0.6

dc beam current density  $\rho = 10^{-6}$  c/m<sup>3</sup>

Find :

- (i) Plasma frequency
- (ii) Transit time across input gap
- (iii) DC velocity of electron
- (iv) Phase constants.

4×4=16

## UNIT - IV

4 Draw the construction of a TWT with helix type slow wave structure. Draw the diagram for bunching process in it and explain the role of

- (i) Slow wave structure and
- (ii) DC-Magnetic field in axial direction in it.

6+6 + 2×2=16

OR

A TWT has following characteristic

Beam voltage = 8 kV

Beam current = 2 mA

Frequency = 4 GHz

Circuit length  $N = 40$

$Z_0 = 20 \Omega$

Find :

- (i) gain parameter  $C$  and
- (ii) Power gain in dB.

2×8=16



## UNIT - V

- 5 (a) Give the total classification of various magnetron and give their comparison table.

8

- (b) An  $\alpha$ -band magnetron has  
Anode voltage  $V_o = 30$  kV  
Beam current  $I_o = 20$  A  
Magnetic flux density  $B_o = 0.336$  wb/m<sup>2</sup>  
Cathode radius  $a = 2$  cm  
radius of vane edge to center  $b = 4$  cm  
Find :  
(i) cyclotron Angular frequency  
(ii) cutoff voltage for a fixed  $B_o$ .

8

OR

- 5 Explain the working of a cylindrical magnetron and find expression for  
(i) cyclotron frequency and  
(ii) electronic efficiency of it.

8×2=16

